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| 09/766,046 | 01/19/2001 | Jamal Ramdani | JG00069 | 9615 |

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OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER

BAUMEISTER, BRADLEY W

ART UNIT PAPER NUMBER

2815

DATE MAILED: 08/07/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/766,046

Applicant(s)

Ramdani et al.

Examiner

B. William Baumeister

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 1 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.138 (a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on Jun 5, 2003.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 2, 4-15, and 43 is/are pending in the application.
- 4a) Of the above, claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☐ Claim(s) _____ is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☒ Claims 1, 2, 4-15, and 43 are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
*See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgement is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s). _____ 6) ☐ Other: _____

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DETAILED ACTION

Election/Restriction

1. Upon further review of the application, the newly assigned Examiner has determined that elected invention I (elected in paper #5 filed 2/6/2002) includes claims directed the following patentably distinct inventions and/or species. Accordingly a further election is required between the following inventions:

- IA. Claims 1, 2, 4 and 32, directed towards a semiconductor structure comprising a mon-substrate/amorphous layer/mono-III-N layer, classified class 257, subclass 190.
- IB. Claim 5, directed towards the invention of Group IA in combination with an additional monocrystalline layer interposed between the amorphous layer and the mono-III-N layer, provisionally classified in class 257, subclass 190.
- IC. Claims 6-15, directed towards the invention of Group IA in combination with an additional template layer interposed between the amorphous layer and the mono-III-N layer, provisionally classified in class 257, subclass 190.
 - IC1. Claim 7, directed towards the species of invention IC wherein the template layer is composed of a material selected from the Markush group of Ti-As, Sr-O-As, Sr-Ga-O, Ti-O-As and Sr-Al-O.
 - IC2. Claims 8 and 9, directed towards the species of invention IC wherein the template layer is composed of a Zintl material.
 - IC3. Claims 10-15, directed towards the species of invention IC wherein the template layer includes a surfactant and cap layer.

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2. Inventions IB and IA are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the combination can be practiced on with a buffer structure wherein the amorphous layer is composed of SiO_x that was new converted from a monocrystalline state. The subcombination has separate utility such as in a structure wherein the BSTO layer constitutes the amorphous layer without the inclusion of an additional monocrystalline layer interposed between the BSTO layer and the III-N layer.

3. Inventions IC and IA are related as combination and subcombination. Inventions in this relationship are distinct if it can be shown that (1) the combination as claimed does not require the particulars of the subcombination as claimed for patentability, and (2) that the subcombination has utility by itself or in other combinations (MPEP § 806.05(c)). In the instant case, the combination as claimed does not require the particulars of the subcombination as claimed because the combination invention could be practiced on a substrate composed of either mono GaAs or mono SiGe instead of on a mono Si substrate. The subcombination has separate utility such as in a buffer structure wherein the III-N layer is formed on the amorphous layer without the inclusion of the optional template layer.

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4. Inventions IC1-IC3 are related as patentably distinct species respectively possessing the mutually exclusive characteristics set forth above. If Applicant elects invention IC, Applicant will be required under 35 U.S.C. 121 to further elect a single disclosed species for prosecution on the merits to which the claims shall be restricted if no generic claim is finally held to be allowable. Currently, claim 6 is generic.

Applicant is advised that a reply to this requirement must include an identification of the species that is elected consonant with this requirement, and a listing of all claims readable thereon, including any claims subsequently added. An argument that a claim is allowable or that all claims are generic is considered nonresponsive unless accompanied by an election.

Upon the allowance of a generic claim, applicant will be entitled to consideration of claims to additional species which are written in dependent form or otherwise include all the limitations of an allowed generic claim as provided by 37 CFR 1.141. If claims are added after the election, applicant must indicate which are readable upon the elected species. MPEP § 809.02(a).

Should applicant traverse on the ground that the species are not patentably distinct, applicant should submit evidence or identify such evidence now of record showing the species to be obvious variants or clearly admit on the record that this is the case. In either instance, if the examiner finds one of the inventions unpatentable over the prior art, the evidence or admission may be used in a rejection under 35 U.S.C. 103(a) of the other invention.

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5. Because these inventions are distinct for the reasons given above, the inventions have acquired a separate status in the art because of their recognized divergent subject matter as shown by their different classification, the search required for any one Group is not required for any of the other Groups, and/or separate examination would be required, restriction for examination purposes as indicated is proper.

6. Applicant is advised that the reply to this requirement to be complete must include an election of the invention to be examined even though the requirement be traversed (37 CFR 1.143).

7. Applicant is reminded that upon the cancellation of claims to a non-elected invention, the inventorship must be amended in compliance with 37 CFR 1.48(b) if one or more of the currently named inventors is no longer an inventor of at least one claim remaining in the application. Any amendment of inventorship must be accompanied by a request under 37 CFR 1.48(b) and by the fee required under 37 CFR 1.17(i).

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Allowable Subject Matter

8. The following is a statement of reasons for the indication of allowable subject matter:

a. The Examiner notes that the common feature of all of the bulk-filing status applications relates to the buffer structure. Specifically, most of the applications set forth the following layers with the optional inclusion of further layers and/or devices: monocrystalline Si substrate / amorphous SiO_x interface layer / monocrystalline perovskite (such as BaSrTiO₃ or BSTO) accommodating buffer / monocrystalline compound semiconductor. Some applications--such as those directed towards waveguide structures--form other monocrystalline perovskites or oxides over the accommodating BSTO layer instead of a compound semiconductor layer.

b. The Examiners assigned to the bulk-filing project have found only two references which teach forming a mono-perovskite on mono-Si by means of an amorphous SiO_x interface layer: Kaushik, "Device Characteristics of Crystalline Epitaxial Oxides on Silicon," and Eisenbeiser et al., Field effect transistors with SrTiO₃ gate dielectric on Si," 6 March 2000, Applied Physics Letters, Vol. 76, No. 10, pp.1324-1326 (which appears to contain substantially similar subject matter). Both of these articles include authors who are or were employed by Motorola, and more specifically include authors Dr. Ravi Droopad and Dr. Jamal Ramdani. Further, various additional news releases/publications quote either Dr. Droopad, Dr. Ramdani and/or Motorola spokespersons as asserting that (1) Dr. Droopad invented the mono-Si/amorphous SiO_x/STO structure (for use as a FET gate dielectric); (2) Dr. Ramdani came up with the idea of employing this particular structure as a buffer system for growing monocrystalline

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compound semiconductor layers on Si substrates; and (3) that Motorola has filed more than 270 patent applications based on this technique or concept. *See, e.g.*, Weiss, "Speed demon gets hooked on silicon," Science News Online, 9/15/2001; "Motorola develops new super-fast chip," USA Today, 9/4/2001; Valigra, "Motorola Lays GaAs on Si Wafer," AsiaBiz Tech, Nov. 2001; and "Holy Grail! Motorola claims high-yield GaAs breakthrough," Micromagazine.com (no date available).

c. The record is presently unclear as to (1) the exact participation others may have had in inventing this subject matter; and (2) whether Dr. Droopad and Dr. Ramdani were employed by Motorola at the time of the respective inventions.

d. The Examiner further notes that various ones of the present applications do not list one or both of Dr. Droopad and Dr. Ramdani as an inventor. Also, various applications--irrespective of inventorship--were filed more than one year after the publication of the Eisenbeiser and/or Kaushik references.

e. The Kaushik and Eisenbeiser references would not be available as prior art if Applicants (1) provide proper and sufficient affidavit evidence of who were the actual inventor(s) of the mono-Si/amorphous SiO_x/STO structure; (2) properly petition to correct the inventorship of any applications not including this (/these) inventor(s); and/or (3) properly petition and amend the status of those applications filed more than a year after the publication of the Eisenbeiser reference so as to make those applications continuations or continuations-in-part of application #09/502,023, now US Patent # 6,492,257, which was filed on February 10, 2000 and issued on

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May 21, 2002, and of which Drs. Ramdani and Droopad were named inventors. (See MPEP 201.11.V for the Office requirements regarding the untimely filing of Priority Benefit Claims and whether this option is available to the applicants in the present circumstances.)

f. If Applicant takes the necessary steps to properly remove the Kaushik and Eisenbeiser references as available prior art, and is thereby successful in overcoming all 35 USC 102(a), (b), (e), (f) and 103(a) issues based upon any of these section 102 paragraphs, the claims would be allowable if they include sufficiently specific limitations relating to these particular layers and their interrelationships. For example, the claims would be allowable if Applicants properly include at least the following limitations:¹

a monocrystalline silicon substrate;

an amorphous silicon oxide layer formed directly on the silicon substrate;

a monocrystalline $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ layer formed directly on the amorphous silicon oxide layer, wherein $(0 \leq x \leq 1)$; and

a monocrystalline [compound semiconductor]² layer formed on the $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ layer.

¹Applicant is invited to contact the Examiner with any questions regarding specific proposals for substantively broader or alternative claim language.

²As noted hereinabove, some applications set forth layers other than compound semiconductors formed on the BSTO so this term would need to be amended accordingly.

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g. If such amendments are made, any restricted claims previously withdrawn from consideration for being directed towards a non-elected invention (such as in response to a product/method, subcombination-usable-together or a combination/subcombination restriction) that depend from such a claim or otherwise include all such claim language, would be subject to rejoinder in accordance with the rejoinder guidelines of MPEP, Chapter 800.

h. The Examiner further notes that a search of the prior art failed to disclose or reasonably suggest a buffering-layer system wherein the BSTO accommodating buffer is subsequently converted to an amorphous layer. As such, any claims directed towards this embodiment would be allowable if they include at least the following limitations--*irrespective of whether the Kaushik and Eisenbeiser references are available as prior art*:

a monocrystalline silicon substrate;

an amorphous $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ layer formed on the silicon substrate, wherein ($0 \leq x \leq 1$);

and

a monocrystalline [compound semiconductor]³ layer formed on the $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ layer.

i. It is further noted that some applications currently possess product claims that recite, *inter alia*, “a monocrystalline $\text{Ba}_x\text{Sr}_{1-x}\text{TiO}_3$ layer,” and also include further claims depending therefrom that recite language to the effect of: wherein the monocrystalline BSTO layer is subsequently heat-treated to convert it to an amorphous layer. **Such claim language is**

³See the previous footnote.

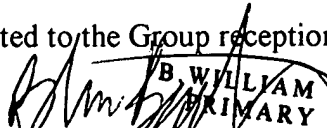
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objectionable under 35 USC 112, 4th paragraph because such depending claims do not further limit nor add additional limitations to the previously claimed subject matter. Rather, such claim language modifies the structure of the parent claim. Accordingly, Applicant should review all of the claims and correct any such dependencies by canceling the claim or placing it independent form.

9. If (1) all of these actions cited above are properly undertaken as required, (2) terminal disclaimers are properly filed, and (3) no other significant issues remain, the Examiner will *consider* entry of amendments that place all of the claims in condition for allowance, even if submitted after prosecution is closed.

INFORMATION ON HOW TO CONTACT THE USPTO

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to the examiner, **B. William Baumeister**, at **(703) 306-9165**. The examiner can normally be reached Monday through Friday, 8:30 a.m. to 5:00 p.m. If the Examiner is not available, the Examiner's supervisor, Mr. Eddie Lee, can be reached at (703) 308-1690. Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.


B. WILLIAM BAUMEISTER
PRIMARY EXAMINER
B. William Baumeister

Primary Examiner, Art Unit 2815

August 2, 2003